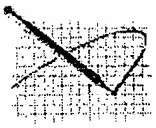
EXHIBIT 1



Chris Dryer

This document expires on

To: Myron Flickner/Almaden/IBM@ALMADEN
cc:
Subject: *IBM Confidential: Invention description draft

A device for real-time interest assessment

Information technologies are becoming quite efficient at transmitting of data. People, however, are not interested in data per se. Rather, people want data that is useful for a particular task, and more
A specifically, people want interesting information. The importance of giving interesting information in communication has been noted by various philosophers and scientists, including H. Paul Grice, who argued that speakers must make their communication relevant to the listener if communication is to be successful.

The problem of determining whether data are interesting to a receiver has been addressed in different ways within different media. In interpersonal communication, listeners provide speakers with verbal and non-verbal feedback that indicates the listener's level of interest. In many mass media, such as
B television, multiple channels that offer some variety information are provided, and the people receiving the information select from the available information whatever seems most interesting. People's selections are then measured, as by the Nelson ratings, so that more interesting and new (potentially interesting) content can be made more available and content that is not interesting can be made less available.

The interpersonal means of interest level detection has an advantage over the typical mass media means. In the interpersonal medium, interest level detection occurs in real time, within a single exchange of information rather than between exchanges of information. The speaker can introduce information,
C assess the listener's interest in the information, and then consider the listener's interests when presenting subsequent information. Mass media technologies typically rely on less immediate feedback. One cost of this is that people have to search through information, looking for something interesting, only to discover that sometimes none of the available information is interesting.

Our invention addresses this problem by assessing and communicating people's level of interest. This works as follows. Initially, whether a person is attending to the target information is assessed. If the person is not attending to the information, we assume that the person is not interested in the information
D at that time. Attention can be assessed in various ways depending on the particular medium. In visual media, for example, people reliably attend to the visual information to which their gaze is directed. Therefore, devices that determine at which target a person is looking, such as eye trackers, can be used for attention detection in the visual media.

Next, a person's relative arousal level is assessed. If a person is more aroused when they attend to
E target information than they are when they are not attending to the target information, we assume that the person finds that information interesting at that time. Arousal in this case is a general affective state and can be assessed in various ways. For example, in interpersonal communication, speakers use facial

expression as a means of assessing arousal and consequently interest. Therefore, devices that determine a person's arousal level, such as facial gesture detectors, can be used to assess arousal.

F By combining data about attention and arousal our device assesses the level of interest a person has in a particular information target. This assessment can then be communicated as feedback about the information target.

G One use of this device would be for an information presentation technology to receive interest level data about various information targets, and then present more information that is similar to the targets that were most interesting and present less information that is similar to the targets that were least interesting.

International Business Machines Corporation
Research Division, Almaden Research Center
Intellectual Property Law Department

Ray Strimaitis
650 Harry Road, C4TA/J2B
San Jose, CA 95120-6099
(408) 927-3360
(408) 927-3375 - Fax
VNET: rays@almaden.ibm.com

June 22, 1998

Via Airborne Express

Sean M. McGinn
McGinn & Gibb, P.C.
1701 Clarendon Blvd., Suite 100
Arlington, Virginia 22209

Subject: IBM Docket #AM9-98-093 "A SYSTEM FOR REAL-TIME DETERMINATION OF A USERS LEVEL OF INTEREST TO PRESENTED INFORMATION"

Dear Sean:

Please prepare a patent application with the subject disclosure material. This application is related to patent application AM9-98-031 "Ticker with Eye Tracking"

If you have any questions, please contact Myron Flickner at 408-927-1776. You can send him mail at the above address, mail stop K57D/B2-250

Thank you for your efforts on behalf of IBM and my department.

Sincerely,

Ray Strimaitis
Counsel

RS:ljs

Enclosure

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PATENTS, TRADEMARKS, COPYRIGHTS, AND INTELLECTUAL PROPERTY LAW
1701 CLARENDON BOULEVARD, SUITE 100
ARLINGTON, VIRGINIA 22209
TELEPHONE: (703) 294-6699
FACSIMILE/DATA: (703) 294-6696; 294-6698
E-MAIL: MCGINNGIBB@AOL.COM

SEAN M. McGINN
FREDERICK W. GIBB, III

July 10, 1998

VIA FACSIMILE AND AIR MAIL

Ray Strimaitis, Esq. FAX No.: (408) 927-3375
Division Counsel
Intellectual Property Law, Dept. DNGA/J2B
Almaden Research Center
San Jose, CA 95120-6099

Re: Estimate on Preparation of Patent Application
"A SYSTEM FOR REAL-TIME DETERMINATION OF A USER'S LEVEL OF ... INFORMATION"
IBM Docket No.: AM9-98-093

Dear Ray:

Thank you for your letter dated June 22, 1998, in accordance with which I have reviewed the invention disclosure and I telephoned Myron Flickner and briefly discussed the invention with him.

I estimate that the services fees for preparing a final draft application and formal papers suitable for filing to be about $4300 - $4600, absent some unforeseen and voluminous extension of the invention. As before, if the actual time spent is less than the estimate, the costs would be less.

Please let me know only if this estimate is not acceptable. We will shortly begin preparing the first draft of the application.

As always, thank you for entrusting this application to our firm. We deeply appreciate the opportunity to work again with you, your department, and Almaden's inventors.

With best regards,

Sean M. McGinn

SMM/s

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***** ACTIVITY REPORT *****
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TRANSMISSION OK

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CONNECTION TEL	14089273375
CONNECTION ID	
START TIME	07/10 13:03
USAGE TIME	00'34
PAGES	1
RESULT	OK

IBM Confidential

From: Myron Flickner on 08/17/98 05:51 PM

To: Chris Dryer/Almaden/IBM@IBMUS
cc:
From: Myron Flickner/Almaden/IBM @ IBMUS
Subject: I'm sending this draft to the lawyer so he can get started
Importance: Urgent

A system for real-time determination of a users level of interest to presented information

Chris Dryer, Myron Flickner

Background of the Invention

The present invention relates to a means of determining the level of interest a user expresses in content. In particular the invention shows a means of non intrusively detecting how interested a user is to presented information. In a typically scenario the content comes from broadcast or cable TV, the web, a computer application, a talk, a classroom lecture or a play.

Description of Related Art

Information technologies have become quite efficient at transmitting of data. People, however, are not interested in data per se. Rather, people want data that is useful for a particular task, and more specifically, people want interesting information. The importance of giving interesting information in communication has been noted by various philosophers and scientists, including H. Paul Grice [1] who argued that speakers must make their communication relevant to the listener if communication is to be successful.

The problem of determining whether data are interesting to a receiver has been addressed in different ways within different media. In interpersonal communication, listeners provide speakers with verbal and non-verbal feedback that indicates the listener's level of interest. In many mass media, such as television, multiple channels that offer some variety information are provided, and the people receiving the information select from the available information whatever seems most interesting. People's selections are then measured, as by the Nelson ratings, so that more interesting and new (potentially interesting) content can be made more available and content that is not interesting can be made less available.

The interpersonal means of interest level detection has an advantage over the typical mass media means. In the interpersonal medium, interest level detection occurs in real time, within a single exchange of information rather than between exchanges of information. The speaker can introduce information, assess the listener's interest in the information, and then consider the listener's interests when presenting subsequent information. Mass media technologies typically rely on less immediate feedback. One cost of this is that people have to search through

information, looking for something interesting, only to discover that sometimes none of the available information is interesting. Our invention addresses this problem by assessing and communicating people's level of interest by passively observing them.

Some related work can be found in the patent literature. In patent 5649061 Smyth describes a device for estimating a mental decision. This is done by monitoring a users gaze direction along with EEG and processing the output signals via a neural net to classify an event as a mental decision to select a visual cue. In other words the device can detect when a user has decided to look at a visual target. The EEG is detected via skin sensors placed on the head.

In patent 5507291 Stirbl et al. describes a method to remotely determine a persons emotional state. This is done by broadcasting a waveform of predetermined frequency and energy at an individual and detecting and analysing the emitted energy to determine physiological parameters. The physiological parameters, such as respiration, blood pressure, pulse rate, pupil size and perspiration levels can be compared with reference values to provide information indicative of the person's emotional state.

In patent 5762611, Lewis et al. describe a method of evaluating a subjects interest level in presentation materials by analysing brain generated event related potential (ERP) and/or event related field (ERF) waveforms. Random audio tones are presented to the subject followed by measurement of ERP signals. The level of interest was computed from the magnitude of the difference of a baseline ERP signal and a ERP signal during a task in this case video presentations. This difference was correlated to the interest level users expressed by filling out a questionnaire about the video presentations. ERP measurement require scalp sensors and although the authors suggest using EMF signals would allow this to be done non-intrusively no evidence that this is possible was given.

In other work, Kamitani and Marutani [10] observed that perplexed behaviours of subject using a word processor resulted in head motion changes more than facial expression changes. They used dynamic programming to match head motion with head motion templates of the following head gestures: nod, shake, tilt, a bend backwards, bend words, and no action. When the subject stopped typing and displayed appropriate head gestures they detected when the person was in a state of confusion In this case only perplexed behaviours not a general level of interest was detected.

Roz Picard from the MIT media labs has done some experiments that have shown that people naturally lean forward when presented positive valance information [3]. (I've asked Roz for a more detailed written reference). In this experiment a mouse with a trackpoint was used and the forward pressure on the trackpoint was measured then correlated with the valence level of presented information.

Summary of the Invention

Our invention improves on previous inventions by giving a non-intrusive way of detecting interest level whereas the prior art has required intrusive detection or detects only emotional

information but not the level of interest.

The first step in the process it to assess if a person is attending to the target information. If the person is not attending to the information, we assume that the person is not interested in the information at that time. Attention can be assessed in various ways depending on the particular medium. In visual media, for example, people reliably attend to the visual information to which their gaze is directed. Therefore, devices that determine at which target a person is looking, such as eye trackers, can be used for attention detection in the visual media. Furthermore, it has been shown that the duration of fixation time is a strong cue of indicated interest. People look at things longer when they are interested in them.

Next, a person's relative arousal level is assessed. If a person is more aroused when they attend to target information than they are when they are not attending to the target information, we assume that the person finds that information interesting at that time. Arousal in this case is a general affective state and can be assessed in various ways. For example, in interpersonal communication, speakers use facial expression as a means of assessing arousal and consequently interest. Therefore, devices that determine a person's arousal level, such as facial and body gesture detectors, can be used to assess arousal.

Finally, by combining data about attention and arousal our system assesses the level of interest a person has in a particular information target. This assessment can then be communicated as feedback about the information target.

There is no generally agreed upon psychological definition of interest. We define interest as a state of high arousal and high attention. Subjects are less interested when they have low arousal - sleeping for example and low attention for example when eye closed there is no attention to visual media. Note that the valance of the arousal state is not a factor in the interest definition. You can be interested in something that suprises you as well as something that disgusts you or confuses you. In our case confusion/perplexity/frustration are just an internal states of interest.

One use of this system would be for an information presentation technology to receive interest level data about various information targets, and then present more information that is similar to the targets that were most interesting and present less information that is similar to the targets that were least interesting.

Detailed Description

As described in the summary there are three steps need to implement the invention. First we need to determine what the user is attending. Second we need to determine the users arousal level. And finally we need to merge the attention information with the arousal level and output a level of interest.

To determine what the user is attending we track the users gaze. There are many methods to track gaze. A good survey of various methods can be found in Young et al. "Methods and Designs: Survey of Eye Movement Recording Methods", Behaviour Research Methods &

Instrumentation, 1975 Vol. 7 pp 397-429. Since we want to observe gaze unobtrusively we prefer a remote camera based technique such as the corneal glint technique taught in patent 4595990 Garwin et al. entitled "Eye Controlled Information Transfer" and further refined in patents 4536670 and 4950069 by Hutchinson. Commercially available systems such as the EyeTrac Series 4000 product by Applied Science Labs, the EyeGaze system by LC technology can be purchased to implement this aspect of the invention. One improvement on the commerical systems that allows for more head motion by using a novel person detection scheme that uses optical properties of pupils. This is described in [18] and in the papers by Ebesawa [4] and patent 5016282 by Tomono also published in [11]. By finding the person using a wide field lens, the high resolution tracking camera can be targeted and avoid getting lost during large fast head and upper body motions. The output of the gaze tracker can be processed to give sets of fixations locations and durations. This can be done as described in [5] or buy purchasing commercial packages such as the EYEANAL [26] package from Applied Science Labs. The fixation locations are mapped to applications/content on a screen/television monitor or object in a 3-D environment. The durations are used to rank the fixation to signal the strength of the interest level. Longer fixation indicate stronger interest levels. In a room setting the gaze vector can be used along with a 3-D model of the room determines what object the user is looking at. Since we now know what the users is looking at we know what the users is currently attending to as well the history of what the users has attended. We also know what the users has not yet seen and thus its interest level cannot be assessed.

The next step is to determine the users relative arousal level. Here we use the technique of analysing facial gestures from video sequences. Ekman [2] created a system of coding facial expressions that has been used to characterize human emotions. Using this system human emotions such as fear, surprise, anger, happiness, sadness and disgust can be extracted by analysing facial expressions. Computer vision researchers have recently codified the computation of these features [19-24]. In addition by observing head gestures such as approval/disapproval nods, yawns, blink rate/duration, and pupil size and audio utterances we get a measure of the arousal level of the user at the current time. This type of detection has been used to detect the onslaught of sleep of drivers in cars [7,8] and U.S. patent 5786765 by S. Kumakura et al, "Apparatus for estimating the drowsiness level of a vehicle driver". Whereas multiple approval nods are a strong indication that the users is alert and interested. In this implementation we don't integrate speech but we wish to point out that it can be used to help decide the persons affective state. Expressions like yeah, right indicate strong interest whereas expression like "bleah", "yuck" indicate strong disinterest.

Blink rate can be measured by simply analysis of the output of the pupil detection scheme [18]. Whenever both pupils disappear a blink is marked and the duration is measured. The blink rate is computed by simply counting the last few blinks over a period of time and dividing by the time. A decreasing blink rate and increasing blink duration is a strong indicator that the users is falling asleep and thus low arousal level.

Upper body motion can be detected by analysing the motion track of the pupil over time. To extract this information we use the technique taught by [10]. We compute x, y, z and tilt angle of the head by simple analysis of the pupils centers. The motion in x and y is computed using a

finite difference of the left and right pupil center averages. A motions in z can be obtained using finite differences on the measured distance between the pupils. The tilt angle motion can be computed using finite differences on the angle between the line connecting the pupils and a horizontal line. Then a distance between the gesture is computing using dynamic programming to the following templates: yes nod, no nod, lean forward, lean backward, tilt and no action. The output of this stage are 6 distances to the 6 gestures. These distance is computed over a the previous 2 seconds worth of data and updated each frame.

To extract information from facial gestures we look at the eyebrow and mouth region of the person's face. The pupil finding technique tells us where the pupils of a person are. From this information and a simple face model we extract regions of the eyebrows and the region of the lips.

To identify the eyebrows two rectangular regions are extracted using the line connecting the two pupils as shown in Figure 1. Aligning the rectangles to the line connecting the pupils allows for side to side head rotation (I don't know gesture) and establishes an invariant coordinate system. The regions are thresholded to segment the eyebrows from the underlying skin. The coordinates of the inside (medial) and outside (temporal) point of the largest blob are found and the perpendicular distance between these points and the baseline are computed. To allow for invariance to up and down rotation (yes gesture movement) the ration of the distances are computed. The muscles of the face only act on the medial point the temporal point remains fixed on the head but the distance will change due to perspective from up/down head rotation. The ratio of the distances reflects changes due to the medial point from face muscles and not head motion.

To identify the mouth we find the mouth again by using the coordinate system aligned to the lines between the pupils. Here we seek to find the corner of the mouth. This is done by searching for corners using a corner detection scheme. Here we use the eigenvalues of the windowed second moment matrix as outlined pages 334-338 of [17]. Then the perpendicular distance between the
mouth corner and the baseline between the pupils is computed.

To summarise, the features we have extracted are as follows: what the user is looking at, his blink rate, six distances to six head gestures, the relative position of his eyebrows, and the relative position of the corners of his mouth. The next step is to merge this information into a measure of interest level. The is accomplished a neural net with the 11 inputs (blink rate, gesture distances, eyebrow distances, and mouth distances) 20 hidden units and 3 outputs. The outputs correspond to interested, uninterested and neutral.

Operation

Claims

What is claimed is:

1. A means of non-intrusive detection of a users level of interest in presented information, compromising:

a means of detecting to what a user is attending ;

a means of measuring a users relative arousal level

a means of combining arousal level and attention to produce a level of interest

2. A means of non-intrusive detecting the object of a users interest in presented information comprising:

a means of detecting the object the user is attending ;

a means of measuring the users relative arousal level

a means of combining arousal level and attention to produce the object of interest

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[3] Affective Computing, Rosalind Picard, 1997, MIT Press

[4] Y. Ebisawa and S. Satoh. "Unconstrained pupil detection technique using two light sources and the image differencing method", Visualization and Intelligent Design and Architecure", pages 79-89, 1995.

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http://www.uwcm.ac.uk/uwcm/dr/groups/vision/em_soft.txt

ASL sells their EYENAL program for general analysis of eye fixations. EYENAL is a suite of special purpose programs. One program converts the raw eye data into fixations. Another program analyzes fixations relative to user defined areas of interest. The fixation program assumes that eye movements

in between fixations are saccaddes and so it reports saccadic starting point, end point, amplitude, duration.

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Between Affect and Cognition", AAAI, Tech report SS-98-2, pages 78-86, 1998

[21] J. Lien, T. Kanade, J. Cohn, C. Li, "Automated Facial Expression Recognition based on FACS Action Units", Proceeding of the FG'98, IEEE, April 1998, Nara Japan

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[24] I. Essa and A. Pentland, "A Vision system for observing and extracting facial action parameters", In Proc. CVPR'94, IEEE, pp 76-83, 1994.

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1701 CLARENDON BOULEVARD, SUITE 100
ARLINGTON, VIRGINIA 22209
TELEPHONE: (703) 294-6699
FACSIMILE/DATA: (703) 294-6696; 294-6698
E-MAIL: MCGINNGIBB @ AOL.COM

SEAN M. MCGINN
FREDERICK W. GIBB, III

November 13, 1998

FACSIMILE TRANSMISSION
IBM CONFIDENTIAL AND PRIVILEGED

To: Mr. Myron Flickner
Almaden Research Center, Mail Stop K57-B2250
IBM Corporation
FAX No.: (408) 927-4020

From: Sean M. McGinn
FAX No.: (703) 294-6696; --6698

Re: First Draft Application
IBM Docket: AM9-98-093
Filing Due Date: As soon as possible (November 30, 1998)

No. of Pages (including this cover page): 27

Dear Myron:

Further to our teleconference on October 30, 1998, I am enclosing a first draft of the above docket including the informal drawings, and which is based on the invention disclosure provided to me.

Please mark up the application and drawings as appropriate and confirm my labeling on the drawings. Please fax me the marked-up first draft at the facsimile number above.

In the application, I have left "holes" for you and the co-inventors to describe features of the invention which require further explanation/ description. Additionally, I would welcome any further features and embodiments which you or the other co-inventors may wish to offer.

In teth Background section, I propose simply identifying the patented conventional systems as simply conventional. This will avoid any admissions or estoppels which could be held against us later. We can submit the patents to the Examiner at the time of filing to meet

our duty of disclosure.

Lastly, I have included some preliminary claims for discussion. Please review them for the desired scope and accuracy as to my present understanding of the invention. As shown, I have included independent claims directed to a system and to a method, as well as some dependent claims which further limit the independent claims. Please let me know if any other features should be claimed. I will add more claims in the second draft including some signal medium claims.

I look forward to receiving your comments and instructions. I will forward a second draft to you as soon as I receive your comments.

Thanks again for all of your help.

With best regards,

Very truly yours,

Sean

Sean M. McGinn

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***** ACTIVITY REPORT *****
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TRANSMISSION OK

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ARLINGTON, VIRGINIA 22209
TELEPHONE: (703) 294-6699
FACSIMILE/DATA: (703) 294-6696; 294-6698
E-MAIL: MCGINNGIBB @ AOL.COM

SEAN M. MCGINN
FREDERICK W. GIBB, III

11:45

November 13, 1998

FACSIMILE TRANSMISSION
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To: Mr. Myron Flickner — FAX No.: (408) 927-4020
Almaden Research Center, Mail Stop K57-B2250
IBM Corporation

From: Sean M. McGinn — FAX No.: (703) 294-6696; –6698

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Lastly, I have included some preliminary claims for discussion. Please review them for the desired scope and accuracy as to my present understanding of the invention. As shown, I have included independent claims directed to a system and to a method, as well as some dependent claims which further limit the independent claims. Please let me know if any other features should be claimed. I will add more claims in the second draft including some signal medium claims.

I look forward to receiving your comments and instructions. I will forward a second draft to you as soon as I receive your comments.

Thanks again for all of your help.

With best regards,

Very truly yours,

Sean

Sean M. McGinn

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1701 CLARENDON BOULEVARD, SUITE 100
ARLINGTON, VIRGINIA 22209
TELEPHONE: (703) 294-6699
FACSIMILE/DATA: (703) 294-6696; 294-6698
E-MAIL: MCGINNGIBB @ AOL.COM

SEAN M. MCGINN
FREDERICK W. GIBB, III

CONFIRMATION

408-927-4020

FACSIMILE

VIA ~~EXPRESS MAIL~~

January 7, 1999

~~December 28, 1998~~

(Total 39 Pgs)

Mr. Myron Flickner
IBM Almaden Research Center
Mail Stop K57-B2250
650 Harry Road
San Jose, CA 95120-6099

IBM CONFIDENTIAL

Re: Second Draft Application
"METHOD AND SYSTEM FOR REAL-TIME DETERMINATION OF A USER'S LEVEL OF INTEREST TO PRESENTED INFORMATION"
IBM Docket No: AM9-98-093
Our Ref: ALM.008

Dear Myron:

Thank you for your comments received on December 14, 1998. Enclosed is a copy of the second draft patent application in the above docket including the informal drawings. Please have all of the inventors closely review the Application and fax back the marked-up second draft to one of the above listed numbers. Please note the Application still needs publication dates of some of the references.

I believe the Application is close to being in final form. I reordered the drawings to be more logical and I also added a number of new claims for more complete coverage. Shortly, after we file the case, we will need an original of the photograph of Figure 2.

Please let me know of any other prior art (patents, publications, etc.) which we should bring to the attention of the U.S.P.T.O. This ultimately will provide a much stronger subsequently-issued patent.

I look forward to receiving your comments and instructions.

Very truly yours,

Sean

Sean M. McGinn

SMM/ap
Enclosures

cc: Ray Strimaitis, Esq.
Division Counsel, Almaden Research Center

PS: We enclose the Declaration and Assignment for your review

****
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****

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LOCATION:	650 Harry Road San Jose, CA 95120-6099		
TELEPHONE:	408-927-	**TELEPHONE:**	
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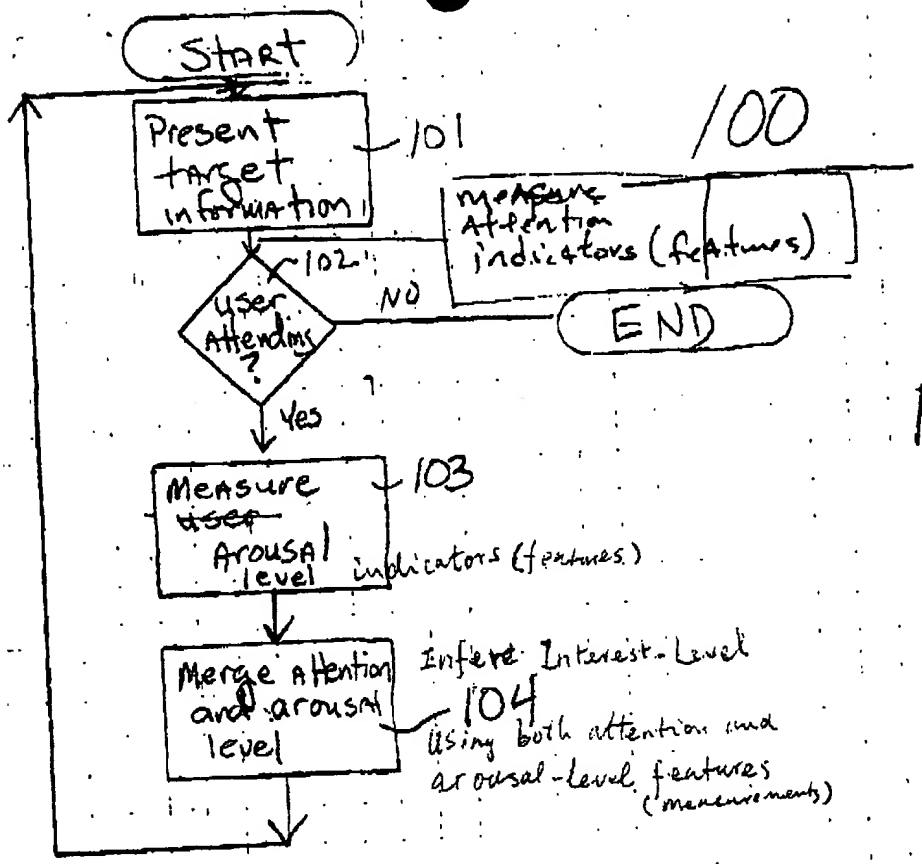

Figure 1

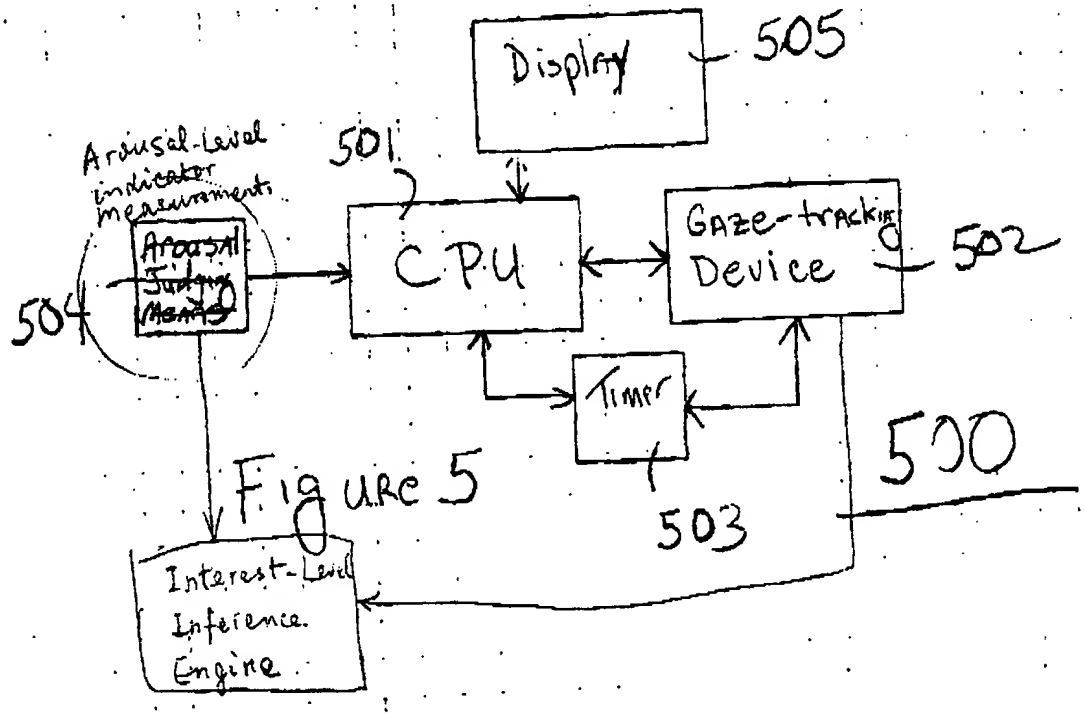

Figure 5

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SEAN M. MCGINN
FREDERICK W. GIBB, III

January 22, 1999

Mr. Myron Flickner
IBM Almaden Research Center
Mail Stop K57-B2250
650 Harry Road
San Jose, CA 95120-6099

Re: Final Draft Applications
IBM Docket No: AM9-98-093 and AM9-98-031
Our Ref: ALM.008 and ALM.002

Dear Myron:

Enclosed are three copies of the final draft applications in the above dockets. Please note that in the -031 docket we changed the first page of the application in the AM9-98-031 docket since the title in the -093 docket was changed. This was the only change in the -031 docket previously sent to you.

After signing the papers in both cases, please overnight or Express Mail all the papers (application, drawings, Declaration, and Assignment) to me. Also, please provide me with any other relevant prior art (patents, publications, etc.) which you believe an Examiner may find relevant to his decision to grant a patent for your invention. I thank you for the references already received.

Specifically, in order to satisfy the strictly enforced duty of disclosure under U.S. patent law, please promptly advise us of any prior art information which is now known or which may become known to those involved in the preparation or prosecution of this application, and which the Examiner may deem relevant to patentability of the claims. Such information should include any commonly assigned patents and pending applications disclosing and/or claiming closely related subject matter.

Very truly yours,

Sean

Sean M. McGinn

SMM/ap
Enclosures

cc: Ray Strimaitis, Esq.
Division Counsel